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THE

NEW ENGLAND

Journal of Dentistry.

VOL. II. JULY, 1883. No. 7.

ORIGINAL COMMUNICATIONS.

THE FORMATION OF THE MATRIX OF DENTINE: OF THE SHEATHES OF NEWMAN, AND THE FIBRIL OF TOMES.

BY R. R. ANDREWS, D. D. S., CAMBRIDGE, MASS.

[Read before the Massachusetts and Connecticut Valley Dental Societies, at Springfield, Mass., June 6, 1883.]

GENTLEMEN: At the request of the Chairman of the Section on Histology, I have devoted the little time that could be spared from a very busy professional season to the reproduction of a paper which I supposed I had, but which I find has been destroyed. I shall not attempt any elaborate treatise, but will give you a few histological points as I see them under the microscope. Six years ago I had the honor to read a paper on this subject before the Boston Microscopical Society (since merged into the Society of Natural History). The conclusions reached at that time, although differing from the theories of the accepted authorities, have to my mind been repeatedly verified by my more recent investigations. A subject of this kind requires the most careful observation, and before presenting that article I devoted a large portion of my leisure moments for a period of two years and over to actual research—making large numbers of specimens fresh from embryos, at about the time of birth, from which I obtained my facts.

Let us consider the form of the dentine germ. At first it is nothing more than a part of the sub-mucous tissue of the jaw, which becomes more rich in vessels and cells than the neighboring parts. It does not present any structure essentially different from that found around it. It speedily assumes the form of the apex of the crown of the future tooth; if a canine, simply conical; if a bicuspid, two cusps, etc. The cells forming its surface become differentiated from the parts beneath it, becoming much larger than the embryonic cells of the germ itself; they are longer than they are broad, and are called odontoblasts or dentine forming cells. They are now ready for the process of calcification. By this description I shall more clearly present to you the views of the generally acknowledged authorities of the present day.

I take it for granted that we are all acquainted with the appearance of formed dentine, with its matrix or basis substance, tubes, sheathes and fibrils. Kölliker, in an article on the development of teeth, in 1868, speaking of these odontoblasts, believes that while the canals and their contents are continuations of them, the matrix is a secretion from the cells, or from the rest of the pulp, and so is an intercellular substance. He believes that a single cell is sufficient to form the whole length of a dental fiber, but in a later edition speaks with some hesitation on this point. Tomes, in his Dental Anatomy, speaking of the odontoblasts, says: "The most external portion of each cell undergoes a metamorphosis into a gelatinous matrix, which is the seat of calcification, while the most central portion remains soft and unaltered as the fibril." Intermediate between the central permanently soft fibril and the general calcified matrix, is that portion which immediately surrounds the fibril, viz: the dentinal sheathe. Thus we have the dentinal fibril in its soft condition little more than the unaltered protoplasm of the cell; the dentinal sheathe, one of those peculiarly resistant substances which is on the border land of calcification; and, lastly, the matrix, a completely calcified tissue.

Waldeyer, in Stricker's Manual of Histology, in describing the development of dentine, says: "The external layer of the germ is formed by a layer of large cells of elongated form, *provided with numerous processes*, called odontoblasts, which are arranged so as to form a kind of columnar epithelium. They are finely granular and destitute of any membrane. The ovoid nucleus is generally contained in that end which is turned toward the pulp. Three kinds of processes may be distinguished in these cells: the dentinal, pulp, and lateral pro-

cesses. The dentinal processes constitute the above described dentine fibers; it need only be here repeated that from one cell several dentine fibers are frequently given off (Boll counted as many as six). Such odontoblasts with such processes are broad at the end directed toward the dentine; but, as the processes pass on, they gradually diminish to form dentinal fibers. The odontoblasts are intimately connected with each other by means of the lateral processes. The short pulp process usually springs from the cell with a moderately broad base, and is constantly connected with one of the cells lying immediately beneath the odontoblast layer." He also believes with Tomes that only the outer portion of the cells calcifies, while the protoplasm of the inner portion forms the dentine process. Wedl remarks, describing the part the odontoblast plays, "The mode of development of the dentine is so far determined that we know positively that the dentine is developed from the dentinal cells. We may also readily demonstrate that as soon as the connection of the dentinal with their formative cells occurs, the calcification of the contents of the dentinal cells begins. That their principal and accessory processes remain attached, and are transformed into dentinal fibers; and that a constant deposition of calcareous salts into the cells takes place from the blood. By the continuous transformation of formative cells into dentinal cells, the process goes on, and new layers of dentine are deposited constantly by progressive calcification."

After thus briefly presenting these statements in a manner I have tried to make plain, I will describe my method of preparing specimens, and then the conclusions I have reached from my own observations. Having found it difficult to obtain fresh human embryos from which to work, I have made my sections from the embryos of pigs, as the processes of development are nearly identical. For these embryos I am greatly indebted to Mr. John P. Squires, of East Cambridge, from whose packing establishment many of the histologists of Boston have been supplied. I first decapitate the embryo, and drop the head into a solution of chromic acid (about one-third of one per cent.) to decalcify it. After from one to three weeks' time, during which the mixture is now and then stirred, I take the heads and wash them in distilled water; then place for twelve hours in a thick solution of gum arabic. It is then transferred to a mixture of alcohol with about one-sixth its volume of water. After a few hours, the gum which has penetrated into the substance of the tissue will be hardened throughout, and the mass can then be cut into such pieces as you wish. The

embedding material is made by taking two-thirds paraffine with one-third lard. This is melted together and poured into some convenient mould, which may be made of paper. While this is still hot, but cloudy from the process of cooling, the piece of tissue selected is placed in it in such position as you may wish in making your section, and allowed to cool. Sections can then be cut across the whole with a suitably sharpened razor, or some of the more valuable instruments for this purpose,—the microtome or section cutter. The cut sections are then to be placed in distilled water for a half hour to soak out the gum, and then stained in alum carmine. I cannot speak too highly of this preparation of carmine for staining embryonic tissue. It is far superior to any of the other stains that I have used, and I have used a great many. I am indebted for it to my friend, Dr. S. E. Wyman, of Cambridge, who obtained the recipe while in the laboratory of Prof. J. Arnold, of Heidelberg, Germany. As given by Prof. Arnold, "take about one gramme of carmine in fifty cubic centimeters of a solution of alum of the strength of from one to five per cent. (best about five per cent). Cook it fifteen minutes (boiling), filter, and then add a little thymic acid (a few crystals)."

I then take the sections I find to be worth saving and place them in this stain for twenty-four hours. Then I wash them quickly in distilled water, place them in absolute alcohol for two minutes, and then in oil of cloves for another two minutes to clarify. They are now ready to mount on a glass slide in Canada balsam and cover with a thin glass cover. A preparation of balsam in benzole is the kind I prefer; it is very handy to use. Valuable specimens for study are made without staining. We must bear in mind that a section which shows its structure with the least possible manipulation is the one to be relied upon. We must avoid shrinking the tissue by the repeated use of reagents, especially alcohol. I cannot urge this point too strongly. I mount many specimens in glycerine and water rather than use alcohol at all, and even with this you have to use care.

Under the microscope, looking at a section cut across the enamel organ, we find it to consist of an internal and external columnar epithelial layer of cells. Just within this layer we find another, the stratum intermedium; within this the whole central part we find filled with star-shaped cells, the stellate reticulum. The cells of the stratum intermedium are intermediate in character between the bordering epithelium and the star-shaped cells. Dr. Beale asserts that he has seen a vascular net-work in the stratum intermedium. I have

never been able to see it. The dentine germ is very different from the enamel organ; everything in it shows vitality. Numbers of minute blood vessels run everywhere towards the surface of the germ. Nerve bundles throw out numberless fibrils toward the odontoblasts; the tissue is crowded with life. The odontoblasts butt up flat against the enamel cells; they are never pointed, as many observers have shown. This appearance is caused by shrinkage, and is not to be relied upon.

The accepted authorities speak of an isolated odontoblast as a cell, having no membrane, with an ovoid nucleus, and also different processes which they call dentine, lateral and pulp processes. They say that the cell calcifies at its outer edges, while the protoplasm in its more central portion forms the sheathe by its partial calcification, and also the fibril, in some mysterious manner wholly unexplained. If my observation teaches me anything, it teaches me that this is all a very great mistake. I have repeatedly seen, and shown to many of my microscopical friends, these cells merging into and forming the matrix or basis substance of the dentine, its nucleus, granules, protoplasm, and all, losing their identity and forming only matrix. The processes they speak of are not really processes of the cell, but are portions of broken fibrils that come from the deeper layers of the germ or pulp. This can be shown by careful manipulation. I have seen these fibrils running between and under the odontoblasts. They break away when the cell is isolated and look like processes, but they are not. The fibrils are not formed from the protoplasm of the cells. They look as though they came directly from a fiber from one of the nerve bundles. I have not been able to trace one entirely, as I cannot make a section on a line with their wavy course. If I could, I think I could prove my point. I have seen the fibrils between the odontoblasts—this is certain. Frey, in his Histology and Histo-chemistry of Man, well says that the study of the development of the teeth, even in its coarser outlines, is one of the most difficult in embryology. As I have said, I believe time will demonstrate that the fibril which is within the sheathe is a filament from a fibril which comes from one of the nerve bundles. I have among my specimens some showing a nearly half-formed tooth of a calf; cross sections of this tooth show just within the odontoblastic layer, and near these cells, very many large nerve bundles, cut across, full of minute fibrils. The open blood-vessels, fewer in number, are nearer the central portion of the pulp. I have also seen, on compressing a thin section showing a cluster of

odontoblasts attached to forming dentine, a fibril or filament running between separated cells from the formed dentine quite a little way into the substance of the pulp or germ. It will be remembered by those of you who are familiar with the writings of Boll* that he has traced fibrils from the nerve bundles running through the pulp, or germ, towards and between the odontoblasts. I have seen, and I can show these filaments running from the germ, between the odontoblasts, up to the formed dentine. These filaments are so transparent that only the most careful examination, with properly directed illumination, will show them. I have certainly proven to my own mind that the odontoblasts lose their identity, and merging into their neighbors, form, when calcified, the matrix; that portion of the odontoblasts surrounding the fibril only partially calcifies and forms the sheathe. New layers are formed by the cells that are seen to be just within the pulp, under the calcifying layers; these become the odontoblasts and they go through the same process.

I look upon the odontoblasts, from continued observation, as having the same function as osteoblasts; and the function of the osteoblast, as I observe it, is only to form the matrix of bone. I believe, with Dr. Sharpey, that the lacunæ cells are bodies or cells left between the calcifying osteoblasts, having a different function. It will be remembered that the emeloblast or enamel-forming cell calcifies, and loses its individuality when calcified, leaving no trace of any former structure. Bödecker has beautifully shown that a very slight beaded filament, or fibril, is found *between* the calcified rods. Those beaded fibers I propose we shall name in honor of the discoverer, the fibrils of Bödecker.

Those of you who have followed my paper closely will have found my conclusions to be:

1. That the odontoblast calcifies and forms only the matrix, or basis substance, of the dentine. When it is fully calcified, it has lost all signs of form and contents. Having no membrane, it merges into its neighbors, and forms the hard portion of the dentine, in the same manner that the osteoblasts form bone.

2. That the sheathe is formed by that portion of the surface of several odontoblasts that enclose the fibril or filament which passes

*He found that by treating a perfectly fresh pulp with one-eighth per cent. solution of chromic acid, an immense number of fine fibers could be demonstrated, a great many of which projected from above the surface, as though they had been pulled out of the dentinal tubes; these pass up from a plexus of dark bordered nerve fibers beneath the layer of odontoblasts.

between them. The portion of the odontoblasts enclosing the fibril only partially calcifies, and is composed of that peculiar substance found everywhere on the border land of calcification—a substance singularly indestructible.

3. That the fibril found within the sheathe between the calcified odontoblasts is a filament either from a nerve bundle or from some other element deep within the formative pulp. From continued observation, I am inclined to think it comes direct from one of the many nerve bundles.

I feel certain, from what I have seen, that later and better observers will prove that I am not wrong in my conclusions. These I arrived at nearly seven years ago. It is gratifying to me to find that so late and so eminent a writer as Klein, in his investigations on this subject, agrees with me on, at least, one important point. Thus, in his Atlas of Histology, page 185, he says:

"I cannot convince myself of the now (since Waldeyer) generally accepted theory, according to which the peripheral part of cell substance of the odontoblast is transformed into the matrix of the dentine, while the central part persists as the dentine fiber. From my observations, I am, on the contrary, led to assume that the superficial layer of cells, or odontoblasts proper, *yield only the dentinal matrix*, while the dentinal fibers are derived from the processes of the cells of the deeper layer; that is, of the cells wedged in between the odontoblasts just referred to."

A HISTORY OF DENTISTRY.

BY GEORGE H. PERINE, D. D. S., NEW YORK.

[Continued from page 166.]

THE THEORY AND PRACTICE OF THE MIDDLE AGES.

Between the time of Aristotle and Galen, who was born at Perganus about A. D. 130, but little progress was made in medicine. Galen studied his profession at Smyrna, Corinth and Alexandria. At the age of 34, he settled in Rome, but often made professional visits to other places. He was undoubtedly a man of great perseverance and deep thought, and has left behind him numerous professional writings, in which he describes the teeth with more exactness than any of his predecessors. His description of the form of the roots of the molar teeth is most accurate, and he asserted that the teeth were connected with a

branch of nerves. He demonstrated that the teeth were not deprived of sensibility when filled, and, as a remedy for toothache, he recommended above everything the use of vapor baths, and the introduction into the tooth of a small piece of wax, pressed well into the cavity by means of an instrument. He taught that the teeth were true bones which were formed in the fœtus, but only became apparent after birth. Galen is very justly called "the patriarch of medicine." He died at the age of 70.

Facts concerning the practice of dentistry during the early portion of the Christian era are not easily obtained, perhaps for the reason that, unlike Galen, the majority of physicians considered its study and practice of little importance. There were not, however, wanting those who went to the other extreme and overrated the benefit the practice of the specialty would confer upon mankind generally. One would at the first appearance of pain ruthlessly extract a tooth, while another would prepare the patient for the operation by copious bleedings, purgations and general persecution of a professional character, until the offending tooth was very likely the healthiest portion of the poor victim's anatomy. As a rule, the patient was within a limited period killed either by too little or too much care.

Bruno, of Longsbuns, favored the burning or cautery treatment. With a hot iron he attacked diseased gums or aching teeth indiscriminately. He opposed extraction by means of instruments, but recommended the application to the root of a mixture of milk, thistle juice and flour, which he claimed would cause the tooth to loosen and fall out.

Gagliardi was the first who described the enamel of the teeth, and obtained sparks from it by striking it against steel.

Clopton clearly established the difference between the enamel and the dental bone, and asserted that in the latter he had discovered traces of the filaments of nerves.

A. Fabrice d' Aguapendente seems to have been a practitioner of considerable merit, and did his operations very much the same as those of the present generation. Thus, when a tooth was carious, he removed the deposit with instruments, destroyed the nerve with a red-hot iron, and proceeded to fill the cavity with beaten gold. He devised many instruments, many of them quite ingenious and well adapted to their purpose.

Peter, of Spain, we are informed, had great confidence in the theories of magic, and permitted his powerful superstition to influence in a great measure his method of practice.

At the time of which we are writing, dentistry had made comparatively but small progress as a science, although surgery was making some little advancement. Occasionally, however, an improvement upon some old and mistaken method would appear which, after some hesitation on the part of the profession, would eventually be adopted. Instruments which were but poorly adapted to the purpose for which they were intended were by degrees rendered less cumbersome and dangerous, and consequently the objection to extraction began to decrease.

The theory that caries was caused by worms, however, gained ground, and held for a long period a prominent place in the public mind. Physicians tried numerous experiments with a view to getting rid of these imaginary parasites. Some burned out the diseased teeth with the wood of the ash and afterward filled up the cavity with honey. Others retained their faith in the inevitable red-hot iron—all having in view the same worthy object, however, that of making the residence of the worm decidedly too hot for him.

As we have before stated, it is generally believed that the Egyptians and Greeks in past ages practiced filling decayed teeth, but their successors of a later period made no attempts at operations of this character, if we except the employment of resinous and aromatic substances introduced evidently into the tooth more with a view to allaying the pain than to arresting decay.

JOHN ARCULANUS is one of the first who refers to the filling of teeth with gold in the middle ages. He paid particular attention to the temperature of the teeth. When the disease was of a cold nature, he believed it was necessary to use warm substances, and *vice versa*. In order that the heat should penetrate as deeply into the tooth as possible, he broached it as far as he was able with a small instrument. Gold filling was not, however, used to any very great extent until the eighteenth century.

BENEDITTI, with blind and amazing crudity, gave his attention to the study of the imaginary worms and their habits. To destroy them he recommended the use of *eau di vie*, but condemns opium as an agent. Judging from the quantity of the first-named, one would be justified in the belief that the erroneous impression regarding worms existed to a large extent at the present day. Beneditti, to impress upon the mind of the practitioner the dangers attending the use of opium, wrote: "I have seen the abuse of this drug plunge a gentleman of Padua into an eternal sleep."

With a seeming anticipation of modern methods of treatment, Jean de Vigo used the file and rasp for removing caries, and filled the cavity with gold leaf. When alveolar abscesses were found, he permitted them to ripen, and then treated them with honey and ointment. He wrote very strongly against the inconceivable quackery and charlatanism prevalent in dentistry, and demanded very justly that only surgeons, and not traveling barbers and mountebanks, should be permitted to practice it. His remarks upon this subject would in some instances be applicable at the present day. Happily, however, dental chairs have been and are being established in the prominent medical colleges, and we are consequently justified in believing that the child, so long estranged from its parent, will soon again be embraced in the arms of its mother; that, in fact, dentistry will no longer be looked upon as a mere mechanical trade, but as an important arm of surgery and medical science.

About the year 1588, Gautier Henry Ryff's work appeared. It was the first book devoted entirely to dentistry as a science. The book did not, however, contain many new ideas, and we find no mention of it in the works of those who wrote about the same time.

A work on Dental Medicine, of which Adam Bodenstein was the author, appeared also in the latter part of the sixteenth century, but its style was eccentric and its theories erroneous. A few other works appeared about the same time in Spain, Switzerland and Italy.

De Coiter Valcherus described, in 1566, most accurately the dental pulp, and explained the difference between the ossification of the teeth and the bones.

About 1653 Duverney published an excellent description of the teeth, observing that in their development and culture they bear a strong analogy to feathers, the nails, horn and hair.

Nerhegan was so strongly convinced of the perfect analogy between the teeth and nails, that he was led to believe that the teeth grow without cessation through life just as the nails do. Were this theory true it would give employment to a large corps of specialists whose duties would constitute the filing down of those teeth which grew so rapidly.

Diemerbroeck commits the singular fault of maintaining that the teeth are formed after birth, and that the roots of the temporary teeth give origin to the permanent ones.

Peter van Forcest, first by an experiment upon himself, discovered that the ulceration of a tooth sometimes sufficed to relieve pain, but

that relief thus obtained was only temporary, and that to effect a cure in extreme cases, extraction must be resorted to; and in this connection he has given the first description of the "pelican," although that instrument had been in use a considerable period prior to his time. He did not, however, consider its use safe, owing to the danger which existed of fracturing the tooth, and he proposed as a substitute an instrument "shaped like the hoof of an ox." Whether his improvement was adopted by the practitioners of his time we are unable to say.

ANTONIO, of Altona, gave particular attention to the subject of odontalgia and suggested remedies in accordance with the cause of the trouble, but in all cases where the teeth were much decayed or loosened, he advised extraction.

J. ANDRÉ DE LA CROIX is reported to have cured an abscess of the jaw by the removal of a decayed tooth.

FLAJANI was of the opinion that André's operation was among the first of this character, performed.

It is said that Achille Permin Gassir extracted one of his own teeth, but with so little skill as to remove a portion of the alveolus with it, and that, owing to the profusion of the hemorrhage which followed the operation he became exceedingly pale, and remained so up to the time of his death, which did not occur for several years thereafter.

FABRICIUS HILDANUS, of Aquapendente, was quite successful in his method of treating fistulas, hemicrania, etc. For the extraction of molar teeth he used the "pelican" adapted to either side of the mouth, and for the front teeth an instrument resembling a crow's-bill, and for the removal of roots one which acted with greater force than the "pelican." Having witnessed the injurious effect of aqua fortis upon the teeth, and superior and inferior maxillary, he recommended in its stead the use of simple dentifrices for their preservation.

JEAN HURNIUS had evidently little faith in the dentist of his time, for his advice was not to be hasty in applying to one because, as he stated, odontalgia often arises from some internal cause with which the dentist has no acquaintance.

STROBELBERGER entertained, however, a more favorable opinion of the specialty, for he advised when a tooth was to be extracted that a skillful dentist should be consulted, "as the operation is one requiring dexterity, which can only be acquired by constant practice."

SEVERINO is reported to have been highly successful in removing tumors from the oral cavity, for which purpose he used forceps made of wood.

CLAUDIUS DEODENTATUS was the surgeon to the Bishop of Basel, and carried with his opinion much weight among dentists of the seventeenth century. He opposed the use of aqua fortis in the treatment of diseases of the teeth, believing that it destroyed the teeth and the alveolar process. He advised the use of dentifrices and general treatment of the teeth and gums.

The belief in dental worms still existing, many ridiculous and singular statements have been made regarding these myths. It is stated that Olig Jacobeus, having excavated from the cavity of a diseased tooth the carious deposit, saw a worm come from it which lived in water for some time. It is quite reasonable to presume that a microscope in the hands of Olig, or, more correctly speaking, beneath the corina of his eye, would have proved his worm a creature of his imagination. But science was in its infancy, and he was consequently permitted to indulge in the harmless pastime of seeing diminutive snakes to his heart's content.

PHILIPPE SALMUTH practiced under the same belief, but his faith in worms was entirely eclipsed by his belief in golden and iron teeth, which the dentists of the seventeenth century believed to actually exist, the presence of which they explained by various theories too ridiculous to mention.

HORETIUS, who wrote in 1595, described a tooth of gold with which a child was said to have been born.

Before closing this chapter we will refer to a few writers and practitioners whose reputations are of sufficient prominence to entitle them to mention.

LOUIS CROW opposed the lancing of the gums before extracting teeth, and recommended the loosening of teeth by moving them backward and forward instead of removing them, as was generally practiced.

VAUGUION, though he advanced dental surgery but little, was by no means favorably disposed toward the employment of the lancet prior to extraction, except in cases of broken or projecting teeth where the "pelican" could not obtain a firm hold.

HENRY MEIBOMEUS was evidently but little acquainted with the diseases of the antrum. He entertained the erroneous idea that the mucous membrane of the maxillary sinus was the cause of the disease. "Some practitioners," says this writer, "endeavor to introduce various medicines in the form of vapor into the antrum, but the best method is to make an opening by extracting a tooth, as the matter

can then escape readily." Meibomeus' father, who was a physician of prominence, practiced with success the same method. By referring to that portion of our work devoted to the practice of the specialty in England, it will be seen that Dr. Nathaniel Hyghmore, in 1643, made some very valuable discoveries regarding the anthrum, by whom it was named.

SCHNEIDER, of Wittenberg, an anatomist of ability, published, in 1661, a treatise entitled "Dr. Catarrahis," in which he explained that the secretions of the nose came not from the brain, as was generally believed, but from the membrane of the olfactory organ.

BENJAMIN MARTIN issued, in 1679, a volume which he called "A Dissertation upon the Teeth." It treated of the nature of the teeth, their sensibility, their development and diseases, but did not advance any theory or method by which they could be preserved. This work, despite its incompleteness, was conceded to be one of equal value with that of Hunard's, which was published in France in 1582.

From the foregoing statements, it will be seen that the veil of superstition, ignorance and bigotry, which had for so long a period enveloped matters relating to the practice of the specialty, and in a great measure retarded its improvement, began in the seventeenth century to dissolve before the light of reason and the advancement of thought and sounder judgment. The literature of dentistry may be said to have sprung into existence about this time, for, during the seventeenth century, more than forty works upon the teeth made their appearance, in addition to numerous general treatises which contributed many valuable ideas to a rapidly developing knowledge.

BACILLUS.

BY J. M. ADAMS.

If the late idea advanced be true—that the bacillus be nothing but fat cells modified—then it would not hold good that they exist where no fat exists, particularly where the fat has all been absorbed.

I once found a spring-poor old bat, so poor that he was about dead and had nothing but a few feathers over his lean flesh and bones, and yet his blood, as well as muscles and lungs, were literally filled with well-formed bacilli. He was really poisoned to death by these numerous bacilli, and not a granule of fat could be supposed to exist anywhere in or about them, and they multiplied all the more, the more diseased the animal became—no fat to absorb, no fat could exist in such a state, and no fat at all.—*The Microscope.*

EDITORIAL.

THE LATE UNION MEETING OF DENTISTS IN SPRINGFIELD.

It was a very pleasant sight to the outsiders to see two societies which, under other circumstances and in other States usually are rather warring against each other, come peacefully together and hold a love feast. This was done from June 6th to the 8th, at Springfield, Mass., by the two societies—the Massachusetts Dental Society and the Connecticut Valley Dental Society, both of whom number about one hundred members each.

The meeting has to be considered a success socially and professionally, in spite of the very oppressive heat that prevailed during the days of the meeting.

Dr. Searle, the veteran dentist in Massachusetts, who is now over forty years in practice, acted as the president of the union meeting. Dr. N. Morgan, of the Connecticut Valley Dental Association, alternated with him. A great deal of the management of the meetings depended upon the executive committee, of which Dr. Bartholomew was chairman, and who displayed his peculiar firmness of character in a way very prosperous to the proceedings of the convention. Many dental stars were present, one of them, Dr. W. C. Barrett, of Buffalo. Who does not know the portly huge gentleman, full of authoritative vigor and vitality? We do not think that Dr. Miller, of Berlin, could have chosen a better agent for his views than the Buffalo doctor. We would like to know that dentist who ever saw Dr. Barrett get tired or short of words. There was one able to cope with him, but he was conspicuous by his absence. It was "Papa" Atkinson. Now how could you, Papa, leave your children thus alone? We only had the excellent crayon portrait of Dr. Atkinson, executed by Dr. Davenport, of North Adams. The picture lacks only two things—mobility of the lips and "shakability" of the hair.

Dr. Niles, whose outward appearance might make one believe that he was very young, shows that the training at Harvard gives to a dentist advantages that years of empiricism cannot produce.

The noted microscopist of Cambridge, Dr. Andrews, was also present, and gave a most interesting lecture on the development of teeth, printed in full in this number. If a phrenologist was collecting proof, he would have to consider Dr. Andrews a fine specimen of the development of the higher faculties.

Dr. Bonwill gave an interesting paper and clinic on the important question of "crowns." Dr. Bonwill is the typified professor; he explains things so that every one has to understand him, in a lively manner, somewhat resembling that of a Frenchman; his stereotype "very well" corresponds to the French "*eh bien!*"

Dr. Buttner, of New York, who gave a clinic on crowns, met with good success.

Dr. Clark, the veteran of the Germ Theory, was also here, raising the value of the meeting by his presence. He gave some very hard nuts to crack to Dr. Barrett, alias Dr. Miller.

And then there was the ubiquitous Prof. Mayr, of Springfield. Many dentists know that young chemist. At this opportunity, he gave a paper on some obstruse philosophical ideas, but thunder showers and the heat made it rather heavy food; and for the purpose of giving the profession an opportunity to study his views, we shall print his paper in the next number. He seems to us to talk rather much, but generally to the point; yet, who can resist replying when all over the globe one is made the subject of discussion, attack and crucial tests?

When we first read articles of Dr. J. L. Williams, then of Vassalboro, Me., now of New Haven, we got the idea he was an old man, about sixty, nursed in all the combined prejudices of Baptists, Methodists, Agassiz, etc.; but when we met him at the meeting we found him one of the most clear-headed, open-minded, rather young and attractive looking men in the meeting. One cannot help feeling very friendly towards him.

Old Dr. Robinson, of Jackson, Mich., who was present too, is as lively as the youngest, full of wit and experience; he has seen more of the dental world than almost any half-a-dozen of men put together.

The general esteem in which Dr. Chandler, of Boston, was held by all present was certainly due to more than his position as professor of the University at Cambridge. He is the translator of several dental works of Magitot, etc., and has been by this fact alone a strong pillar of their reputation.

Dr. Brackett, of Newport, R. I., newly elected to Harvard University, Dr. Coolidge, of Boston, Drs. Lovejoy and Bazin, of Montreal, helped to increase the splendor of the meeting by their presence. Taking it all together, it was perhaps as large and influential a meeting of dentists as Massachusetts ever saw.

Dr. Charles A. Brackett, of Newport, R. I., has been elected professor of dental pathology and therapeutics by the officers and fellows of Harvard College. Prof. Brackett, as assistant professor, has filled the chair for two or three years past, and we now extend to him our hearty congratulations on his well deserved promotion.

SOCIETIES.

UNION MEETING OF THE MASSACHUSETTS AND CONNECTICUT VALLEY DENTAL SOCIETIES, HELD AT SPRINGFIELD, MASS., JUNE 6, 7, AND 8, 1883.

First session, June 6, opened 2 P. M. in Gill's Hall.

Dr. F. SEARLE, president of the Massachusetts Dental Society:

Gentlemen of the Massachusetts Dental Society and the Connecticut Valley Dental Society,—

It is incumbent upon me to open this meeting and to call the convention to order, and in doing so allow me to tender you the hearty welcome of the dentists of Springfield. We are greatly obliged to you for having done us the honor to make this your place of meeting.

The weather is rather warm, and possibly you may not feel disposed, after the convention, to spend much time in visiting the various places of interest and some rare works of art and architecture which we possess; but, so far as you may be able to do so, we shall be happy to give you all the assistance in our power.

Let me say to you, gentlemen, that we have one work of art especially deserving your attention. You can see costly and nice buildings everywhere; you can see all the modern works of architecture, but such a specimen of architecture as may be seen in the old Springfield bridge you will not find elsewhere. We welcome you especially to this.

The executive committee has placed before us the two main questions of to-day, which will come before you for your investigation. I refer to the Germ Theory and its merits in comparison with the old Acid Theory—perhaps I should not say *old* acid theory, because it is only about forty years old—and, also, the merits of the different processes of pivoting teeth. I use this term because you all understand it, viz: Artificial crowns are put on remnants of teeth, which is nothing more or less than an engrafting of artificial teeth upon dead teeth. I hope that, in this discussion, the question of the advisability of using old roots in this way will be especially noticed.

Without going further, I give you a hearty welcome and hope you will have a pleasant meeting. The two societies have each their own set of officers. What action will you take under these circumstances?

Dr. BARTHOLOMEW: The executive committee of the two societies instructed me to move that the officers of the union meeting be those

of the two societies—Drs. Searle and Morgan to preside at the various meetings. (Voted.)

Section No. 1 not being ready to report, Section 2—Pathology, Therapeutics, Etiology and Diagnosis, was taken up. Dr. Stockwell, of Springfield, chairman of section, reported that two important papers were to be presented under this section, both of them by men to whom they would most gladly listen—Prof. Chas. Mayr, of Springfield, Mass., and Dr. W. C. Barrett, of Buffalo, N. Y. It is desirable that Dr. Barrett's paper on "The Experiments, Observations and Conclusions of Dr. W. D. Miller, of Berlin, Germany, concerning Dental Caries," should be deferred until to-morrow. Prof. Mayr is present, and ready to present his paper. (To be published in next number. ED.)

DISCUSSION.

Dr. W. C. BARRETT: It affords me great pleasure to be with you to-day, in that a large proportion of my life has been devoted to the profession which I have chosen as the highest aim of my life. There are men in our profession who arrange things and facts and ideas and thoughts, and present them to us in a new form—perhaps more practical. Such men are very useful, but those who are doing original work—the man who goes back and looks with his own eyes on the phenomena presenting themselves—that man is the one to whom we listen with a great deal of pleasure. Prof. Mayr, although not a professional dentist, has engaged himself in this kind of work, and whenever he speaks I listen to him with pleasure. Whatever he writes, I read with profit. It does not matter whether I agree with him or not. To any man who gives me new thoughts I am thankful, for I think if we all saw things alike, and would all look through the same kind of spectacles, there would not be much progress. If every man was posted and planted in the ground, and should say, "I am always consistent, you can always find me there, you know where I stand, and where to find me," I would not give "that" for that man. If we are to derive profit from discussions, it is from some man with whom we come in collision. You may strike two rolls of butter together and you will never get any fire out of them, but when you have a piece of flint and of steel, and you strike them, you will get fire. If two minds which are acute, strike, you may get something; and on the ground of this consideration I should be glad if in any way I could come across Prof. Mayr. I should hope to strike fire from him. The subject of Etiology is striking at the foundation of dentistry. The man who

attempts to treat pathological conditions without understanding the cause which leads to that state of disease, is simply an empiric. But when we go back and understand principles, how we get this condition and how we get that one, then we begin to practice intelligently. There is no more vital question than this in all dentistry. When we come to pathological conditions, whence came it? what was its origin? Is it the cause of some change or the interjection of some force, or does it originate in a malconstruction? Take, for instance, the investigations of Prof. Mayr. They have led him to the conclusion that he has found the cause for that disease of teeth which all of us combat; he ascribes decay to certain organisms which are found in the mouth. I am quite ready to agree with him that a great many zymotic diseases are due to microscopical organisms, of which we knew nothing a few years ago. The telescope does not reveal greater creations outside of our globe than does the microscope. The infinitely small is much more than the infinitely great. The difference between planets, between orbs, between worlds, is not so great as the difference in the microscopical world. The animals which roam through the inexplorable African forests, if we should be transported there and should meet them, forms of which we have never heard and which we have never seen, they would not astonish us as much as when a man looks for the first time down through the tube of a microscope at the infinitesimal world and the wonderful forms there seen. The infinitely small creation transcends the infinitely great. The microscopical forms of life transcend the macroscopical ones.

Man's thoughts are apt to run in channels. When the high water of the river comes down, all the driftwood lying along its course is swept into the current, and all goes down together. The same is true of the sciences. When Pasteur and Koch made their investigations, and determined to their own satisfaction that certain pathological conditions were due to the action of minute organisms, we are so apt to ascribe everything on earth to the same cause. If they show that cholera and many of the zymotic diseases are the results of microscopic organisms, we ascribe all conditions to the same cause. We are apt to seize one point, and look only at that, which we have to guard against. I think we have made greater progress in the dental profession in investigations of such kind than ever before. Right here in Springfield, right here in this city, has been a center from which has gone out an influence which will be felt throughout the world of dentistry. It is but a few years ago that it began here,

and from this center in Massachusetts has spread all over the world. I am speaking generally. I want to state the platform upon which we all can stand. We have not reached our ideal. We have proved the presence of micro-organisms. I do admit that microscopic organisms do have a large influence in caries, but cannot admit they are the sole cause. I am not ready to admit that they are even the primal cause.

I occupy a somewhat anomalous position. When, two years ago this summer, I had occasion to meet a young man, an American, who was expatriated by his own choice, a man who was an enthusiastic dentist, an educated man, a student in every meaning of the term, a man of such a lovely spirit which does us good to meet, and which we hold to our hearts whenever we meet them. There he was, in a foreign country; he was making scientific investigations; he was alone in that there was no dentist to assist or sustain him. He wanted to retain his place among American dentists. He said, "I am at a great disadvantage; I desire to be known to the profession; I am so far away, I cannot speak to them; I cannot enter into the discussions; I cannot present my views to the profession in general; the only way in which a man can make progress is by coming into collision with others. I have nobody for that purpose." We had considerable correspondence. He finally asked me if I would become his mouth-piece. I was delighted with the offer, and said I should be glad to present, whenever there was an opportunity, in the best manner that I could, anything he might desire to say, before the profession. At that he sent records, slides, diagrams and drawings. As he commenced, and the subject began to open itself before him, he took a certain ground. After six months, he said, "I have to review the whole thing; I am satisfied I am wrong." Then he went to the other extreme. A short time afterwards, he said, "I have got to modify again my views." And so that man has gone on, and there is perhaps not a man in the profession that has been superior in the number of experiments and observations and studies to Dr. W. D. Miller, of Berlin. Your executive committee invited me to come here, but when Dr. Miller invited me to become his mouth-piece, it shut my own. I have agreed to be Dr. Miller's mouth-piece, and to present his views whenever he desired to have them presented. If I do that, loyalty demands, if I hold views which are not in accordance with his, that I should not create any antagonism; if, on the other hand, my views coincide with his, loyalty demands that I present none

of them, because they are his views. He wrote a paper expressly for this meeting, when he learned that a meeting would be held here. As I have the pleasure of presenting to you his views, I have nothing of my own to present.

SECTION 1.—*Anatomy, Physiology, Histology and Microscopy.*

Dr. S. E. Davenport, of New York, chairman.

Paper by Dr. R. R. Andrews, of Cambridge, Mass. (to be found in this number in full).

DISCUSSION.

Prof. MAYR: I take the liberty to say a few words in regard to the paper of Dr. Andrews.

It is an excellent paper, but, as I have pointed out in my paper, the treatment with chromic acid seems to have produced a series of troubles; the authorities and microscopists are very much in doubt about the presence of lime-salts. As long as they treat their specimens with chromic acid and remove the lime-salt, they must not expect anything else. As soon as we remove the lime-salts to accommodate the razors of microscopists, we are thrown into confusion, and have to guess where they were. That is no scientifical way of investigation.

Dr. Andrews speaks further of picking out certain slides and rejecting others: also that seems to me to offer an objection. We must look at all the slides that can be made from one specimen.

Prof. ANDREWS: I would merely say that the specimens were taken at a time when there was no lime yet deposited.* I do not care to see them. Then in making the slides, many did not contain anything about the teeth, and were therefore useless.

The chairman of Section 3 not being ready to report, a paper on "Fisk Caps and Method of Application" was given by Dr. H. C. Meriam, of Salem, Mass.

(Will appear in one of our next numbers).

Adjourned.

EVENING SESSION.

Opened at 7.30.

SECTION 3 taken up—*Chemistry, Materia Medica and Anæsthetics.*

Dr. E. S. Niles, of Boston, chairman.

Paper of Dr. Niles on the "Chemistry of Decay."

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*That is precisely the point. How does Dr. Andrews know that they were not there after he has treated them with chromic acid? He would surely have dissolved them out.—M.

(Paper given in extract).

Dr. NILES: Whatever differences of opinion may exist upon the causes, progress and character of caries, there seems to be a general agreement that the condition rendering decay possible is a faulty development of the structure, and in a general way it is recognized that the imperfect formation of enamel and dentine has to be attributed to scanty assimilation of the material that makes a typical development of structure. Those changes which occur in the progressive development of embryonal teeth are imperfectly understood. We know that all important tissues and organs of men are evolved from minute masses of cellular matter, called bioplasm. The hardness of a tooth is in the proportion of its lime-salts.

First take enamel, the hardest substance about the tooth, and we find it to contain a greater amount of lime-salts than dentine. I have these analyses:

Enamel, 89.82
Dentine, 66.72
Bone, 54.51

The first two analyses are by Bibra. The last by Wurz.

It is seen that the analyses of those eminent authorities differ from the conclusion drawn by other men, in that a large amount of lime-salts is present in the hardest dental tissue. In later life, the teeth contain a great proportion of earthy material. Among most of those who have made dental pathology a study, it is generally recognized as a fact that teeth resist in proportion to the amount of lime-salts in them. Among the conditions rendering decay possible are a faulty development of the structure and lack of earthy salts. Speaker refers to the practice of prescribing lime-salts in diseases when the lime supply seems to be deficient.

As in all theories of decay there are some truths that claim our attention, so in the most recent one, there are facts which contribute to the final solution when dental caries shall have been fully explained.

After one has studied the Germ Theory, it would seem clear, whatever its defenders might prove with reference to soft tissues, that further light from it will be small if applied to hard tissues.

If those who advocate the Germ Theory admit that acids unclose the organic matrix of teeth, they explain what Magitot's experiments prove, that caries are produced by the product of fermentation carried on about the teeth.

Fermentation is the spontaneous change of a liquid or a substance which results in producing substances which differ from those previously existing.

Putrefaction is the decomposition of animal substances when deprived of life and placed under especial circumstances, viz: a temperature of about 70° Fahrenheit, and the presence of moisture.

The most common products of putrefaction are water, carbonic acid, acetic acid, carbureted hydrogen, etc., and the volatile odors of putrescent substances. Both of those processes are attended by swarms of micro-organisms.

At present, the names of bacteria, germs, micrococci, etc., are given to races of organisms whose names are legion. We take untold millions in our drinks and food.

It is claimed that a peculiar species is responsible for every known disease. We have small-pox germs, yellow fever germs, and, in the minds of men with strong imaginations, a germ destructive to human teeth during life; but, strange to say, at the death of the human body, its ravages cease. The soft tissues are destroyed, but the teeth and bones are left with their usual density for many years. It seems strange that the supporters of the Germ Theory of decay should maintain the position merely because those germs are found in the cavities of carious teeth, when it can be proved by experiments out of the mouth that germs have no power whatever to decalcify tooth structure. The only portion favorable to their production is the organic portion. According to the analyses of Bibra, the enamel structure in an adult consists of lime, magnesia, and other salts, 96.41; organic substances, 3.59.

It is readily seen that but a small proportion of the enamel structure is favorable for their propagation, as it is buried or loaded down with great quantities of lime-salts, which act as barriers to the progress of germ-reproduction.

But the editors of the *New England Journal* teach that bacteria excrete or secrete an acid. In other words, that they are acids forming bacteria; and, after feeding themselves, crowd down the tubuli and there disgorge themselves of the destructive fluid.*

The question is, are the acids products of the living organism, or are they directly chemical products. I have very good reasons to believe that the advocates of this theory will find ample authority in

*This is a gross mistake on the part of Dr. Niles, and shows a reading so careless that—we are sorry to say it—to all his statements an ? must be appended.—Ed.

the works of Beale, Pasteur and Tyndall, to convince them that these acids are formed by the ultimate decomposition of proximate principles.

For example, fermentation is a decomposition of starch and sugar, and the recombination of their ultimate principles—oxygen, hydrogen and carbon in new proportions. This breaking up is brought about in the time of reproduction of the germs; and when we call to our mind the marvelous rapidity with which they are produced, under favorable circumstances, it is doubtful whether they have time for anything else, especially in the presence of enamel and dentine.

In a final sentence, Tyndall says: "There can be no doubt of the fact that for the nutrition and multiplication of bacteria, acid infusions are less favorable than neutral or slightly alkaline ones." From reliable sources of information upon the subject of bacteria, we are led to the conclusion that their object is to reproduce themselves and to exist at the expense of decomposing matter, and that the fluid which best favors their germination is not acid, but neutral and alkaline. Further proof is presented every day to the practitioner during the progress of the affection known as Riggs' disease. The pockets formed at the root of the teeth and in the surrounding gums would be a favorable condition for the germs to decompose the tooth structure. It is found, however, that caries of the root with Riggs' disease seldom occurs. Beale and Pasteur first demonstrated the presence of germs and their multiplication in soft tissues under diseased conditions. Lister was the first to make practical application of this knowledge in the use of the carbolic antiseptic treatment of wounds.

A small quantity of carbolic acid arrests germinal development, and if this is used in carious teeth, decay will be arrested. I am aware that this has been offered as evidence that germs cause decay. It kills the germs, but it is also true that carbolic acid arrests fermentation and putrefaction, and therefore no organic acids can be developed.*

Speaker refers to the experiments which he supposes to prove that germs alone do not decalcify tooth substance. Teeth were ground up and placed in a liquid containing decay of teeth, but care was taken to keep the liquid neutral or slightly alkaline. At the end of two months, not a trace of lime can be found in the solution, nor is there the least softening on the surface of the teeth, while millions of spores, germs and bacteria are floating in the fluid.

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*"Carbolic acid arrests fermentation and putrefaction" because it "kills the germs." Therefore, no "germs," no fermentation or putrefaction, and, consequently, no caries.—Ed.

Some experiments or tests on caries have recently been made which are said to prove the absence of acids along the line of action, as I am informed. These tests are for acetates, lactates and nitrates of lime. From the same source comes the statement that litmus is not reliable and does not prove the presence of acids.

In answer to this statement, I would say that the absence of lactates, nitrates and acetates of lime, even in fifteen cases, is not sufficient to prove the absence of at least fifteen or twenty other organic acids which may assist in changing the tooth structure. Nor is it reasonable to suppose that under the fermentative action in the presence of varying quantities of numerous acids and acid salts, any acid salt can be created in sufficient quantities to respond to any known test. It has been said from this same source that all carious tooth cavities are a whole chemical laboratory. (Oh, no, Dr., not "from the same source." Again, a mistake.—ED.) With some modifications, I am inclined to accept this statement, and if, by chance, acetates and lactates should be formed, their existence would be of short duration. About the litmus test for acids, in this case it must be regarded as very significant that the healthy flowing saliva turns red litmus blue, and this also destroys the power of teeth to turn it red. It is also true that litmus usually indicates alkalicity around sound teeth in the mouth. But where decay has made much progress it indicates acids. By experiments on forty teeth, it was proved conclusively that decay has an acid reaction. Every argument only proves to strengthen the conviction that acids are the primary local cause. The existence of organisms in decay is rendered possible by the continual exposure of the organic substance of teeth, and the contribution of favorable substances from food and saliva, and their being kept constantly in temperatures favorable to their reproduction. It has also been said that decalcification out of the mouth does not resemble decay. I have decalcified some teeth which I will show you, and I leave it to your judgment whether it looks like decay or not. This decalcification was done by dilute *muriatic acid.* Speaker proved the presence of lime-salts in the solution.

Prof. MAYR: To answer Dr. Niles in some of his points is very easy. First, he has given you a table by which he wishes to prove that the hardness of a structure, like teeth, depends on the amount of lime-salts. To prove the fallacy of that view, I will complete the table:

Chalk, 98 per cent. lime-salts.
Enamel (Dr. Niles), 89.82
Dentine, " " 66.72
Bone, " " 54.51
Chitine 4.

By simply arranging my figures in this way, you will see that it is a fallacy to make hardness—a perfectly physical property—depend on the chemical composition.

Chitine, with only 4 per cent. of lime-salts, is much harder than chalk with 98 per cent. Furthermore, if we pound up a tooth, we do not change its chemical composition, but its hardness is completely gone. You see, therefore, that hardness has hardly anything to do with the *chemical composition*, but depends mostly on the STRUCTURE.

The structure of a tooth is its physical arrangement, and the difference between hard and soft teeth, as between hard and soft steel, is but very little in their chemical composition, but in the arrangement and disposition of their molecules.

Another point I would like to touch is about the litmus test. I did not dispute its reliability. I only disputed that it teaches us anything about the origin of these acids. We have always to take into consideration that the cavity of a decaying tooth receives food supply from without—sugar, starch, etc. These, if fermented in the teeth, will produce acids. These acids may help in the destruction of teeth, and by combining with a part of lime, produce—as Dr. Niles once stated to me on a former occasion—acid phosphate of lime. But the acid phosphate of lime can never decompose the normal phosphate.

But how do starch and sugar ferment? *Has Dr. Niles the very least evidence of this fermentation being possible without lower organisms?* Not one authority yet has been found that could prove that starch can be *fermented* into lactic acid without the presence of germs.

Gentlemen, the "bugs" are here again. You may try to throw them out by window and door. They are at it again!

Dr. Niles simply seems to me to amplify the Germ Theory by showing some details.

Those gentlemen who are often referred to as the defenders of the Germ Theory, some of them connected with the *New England Journal*, as far as I know, have only put up the proposition to be proved or disproved, viz: *Germs are the essential factors of decay.* The *detail* of their action, as we have often insisted upon, we do not

know. Dr. Niles has furnished valuable points by showing that fermentation and putrefaction together will destroy teeth and produce caries. But he seems to me to be wofully at loggerhead about the *difference* between fermentation and putrefaction. The difference is clean and clear: fermentation is the change of non-nitrogeneous substances into other non-nitrogeneous substances *by the presence and action of lower organism*, called germs or ferments; putrefaction is the change of albuminous substances into other, generally offensive, combinations *by the action of lower organisms*.

If we have a mixture of non-nitrogeneous and albuminous substances, e. g., sugar and meat, first fermentation sets in, and only after all the sugar has been transformed into acids, etc., putrefaction begins. If we now supply fresh sugar, etc., both processes go on at the same time. The same seems to me to be the case in teeth. The food supply from without may undergo fermentation while the tooth substance undergoes putrefaction; one will aid the other by furnishing a more varied bill of fare to germs. But what we insist on is *that none of these processes would take place without the presence of germs*. I think this point is very clear. Dr. Niles certainly does not wish to have that experiment with the fluid which he kept alkaline and found that no destruction of the tooth substance took place, to be taken seriously; he is too good a chemist for that. How did you keep the fluid alkaline or neutral?

Dr. NILES: By carbonate of potash and ammonia.

Prof. MAYR: Dr. Niles is too good a chemist not to know that a solution which contains an excess of carbonate of potassia cannot possibly contain in solution any lime-salts. Therefore his triumphant conclusion, "You will find no lime-salts in that liquid," would seem to me rather to be intended for sophistry than for any serious argument. He supposed that you would not know the chemical point, but I think he was mistaken.

How often has the reaction of putrefying and fermenting liquids to be stated? A liquid that is purely putrefying is *always alkaline*. A liquid that is fermenting, is *acid*. We may get mixtures of the two, and then the reaction will be a mixture; but we have to state that in our words, otherwise they would become inexact.

Dr. NILES: Prof. Mayr claims that hardness has nothing whatever to do with the presence of lime-salts. I claim it has, by the analysis of five recognized authorities. He further says there is no decay without germs. We admit that the germs are there, but Magitot, in his

work translated by Prof. Chandler, says: "Acids are produced by fermentation and putrefaction of organic substances, and that they are what he calls the exciting action of decay." That is the point we wish to make.

Dr. STOCKWELL: The father of the Germ Theory, Dr. F. Y. Clark, is here. It might be interesting to hear from him.

Dr. F. Y. CLARK: I have just got in and feel a little weary, but I should like very much if you will give me a little time—I hope the subject will come up to-morrow—to go into the histology and prophylactic treatment of caries, and should like to correct a few mistakes of Dr. Niles.

Dr. WERNER: I would like to ask a question. If food containing sugar is so important to the development of acids and micro-organisms, why do people who apparently eat most sugar, like the Negroes in the South and the Esquimaux in the North, have less decay than we, and why have our intellectual prodigals, nervously active but physically degenerated, so much decay?

Dr. Codman relates some experiments that he made with teeth that he put into a solution of molasses and sugar, and sugar alone, and, after four or five months he found them very much softened, in a condition very much resembling decay. The teeth could be bent back, still retaining all their form. I showed them to some gentlemen, and it seems to me that it was a similar process to that producing decay.

Dr. BRACKETT: I saw the teeth after they were dried, but the point usually is, whether it is the pure sugar which produces the effect or whether the sugar has undergone fermentation. My guess would be, it first developed an acid, and that this produced the effect rather than the sugar.

Dr. SEARLE: I would like to ask Dr. Codman what the result was in the case with the granulated sugar?

Dr. CODMAN: The tooth in the granulated sugar was also softened, but not nearly so much as the other.

Mr. MCDOUGAL: Was the condition of the liquid neutral or not?

Dr. CODMAN: Making very simple experiments, I did not test it.

Dr. CLARK: If Dr. Codman had examined his specimens with a microscope, he would have found myriads of bacterium termo.

After a short discussion on these experiments, the subject was dropped.

Dr. CHANDLER: Reference was made to Magitot. I should like to say that the first edition of the translation of Magitot's work is not yet sold. I would advise somebody to buy and read it.

Dr. WERNER: I think that these gentlemen are entirely mistaken. I do not think that acids alone, or germs alone, produce decay. That seems to me a pretty far-fetched hypothesis. Why should germs eat away the tooth? They are very harmless; they do not hurt much anybody; but when you bottle them up, as was done by Dr. Codman, in sugar, then you get action. I am not afraid if an acid solution comes on my teeth so long as my glands secrete saliva that will protect them. And as for the micro-organisms, I am not a bit afraid of them. I think you pay too much attention to those things. You must look at the physical conditions; you must look at the nervous conditions; the mental activity. It is the excessive indulgence in nervous occupations, in things concerning the nerves and not the muscles, the sitting in crowded rooms and studying, that makes children's teeth decay. I come back to the question, Why do Negroes in the South, eating much sugar, and the Esquimaux, not have so much decay as we do?

Dr. BARTHOLOMEW: I would like to have another question answered. I had a patient who had the malaria very badly; that patient's teeth were in an excellent condition at the time she was taken down. She was sick about five weeks, and during that time her teeth became decayed—not around the roots next to the gums, but on that portion where the teeth had been filled, decay had started, and nearly every filling became loose. I got the prescription the doctor had given; it was quinine, with sulphuric acid to act as a solvent; that was the medicine taken and that the effect produced.

Prof. MAYR: To answer Dr. Werner, I would say that I question the logic implied in his statement of the sugar-eating Negro. It can be shown that the teeth of the two nations eating most sugar—the Americans and the Swiss, show almost in proportion the most decay. That is at least true of the Swiss, who have the worst teeth I ever saw. Also, people who eat but little sugar have occasionally very bad teeth, like those in the eastern provinces of Prussia, while the Russians have most excellent teeth. There is no doubt that the mental condition has something to do with the growth and spread of decay, but only by changing the internal resistance. We have not yet made out which exact factor of internal resistance is changed. In the case of Dr. Bartholomew, it seems to me that the acid destroyed the prominent edges of the teeth around the fillings, and thereby furnished a new point of attack to lower organisms. Here the acid may be said to be the primary cause of the trouble, but without the further

action of germs, we only would have had abrasion, and no decay. Another statement perhaps of interest I would like to make: I went with Prof. Putnam, of Cambridge, to what are supposed to be Indian graves along the Connecticut river; we found some skeletons, and a lower jaw with most of the teeth in it, but at least nine teeth showed plainly decay, showing that those races who were probably not worried much with over-study or sugar eating, had the same process going on in their mouths as we.

Dr. NILES thinks that those teeth ought to have been eaten away entirely by germs, together with the rest of the body.

Dr. F. Y. CLARK: I would say I cannot remain quiet when such nonsense is spoken. We all know that germs require moisture. When teeth are extracted and put on our shelves or laid aside, the meshwork of the teeth dries up, or, in other words, the bioplasson has ceased to become proper food for the organisms. The same was the case in the Indian skulls; the bioplasson was changed, and there was no further inducement for germs; that is the whole cause of decay not progressing there.

Dr. NILES: During the early stages of putrefaction was there not a great deal of moisture about the bones?

Dr. F. Y. CLARK: Yes, but if you try the experiments out of the mouth, you get unnatural conditions; the experiments in the mouth would be entirely different. If we try experiments upon teeth out of the mouth, we arrive at nothing. The living portion of the tooth is changed very much by its removal. If we could magnify enough a whole tooth, we would see it a perfect mass of meshwork; in this is the fluid which we call protoplasm, and that is what the germs are after. Dr. Miller has shown conclusively that they work way up into this meshwork. They do not "*eat*," because they have no mouths; they are plants, not animals, and they live by absorption; they absorb protoplasm and the lime is disintegrated; that is the whole thing.

Prof. ANDREWS: I would suggest that you take a look at the thirteen thousand skulls in the Cambridge collection. In those skulls of the Mexicans and Peruvians, you would be somewhat surprised to see how much decay there is. Many of the Peruvians have defective teeth. A great many of the early mound builders had them too; only those of the Sandwich Islands are free from decay.

Adjourned.

HARVARD ODONTOLOGICAL SOCIETY.

[An abbreviated report of a late meeting. Published by request.]

Subject for the evening—FLUIDS OF THE MOUTH.

Prof. CHAS. MAYR: When I was invited by your Executive Committee to give a lecture before this society on the fluids of the mouth, I found it a very agreeable subject for me. If I had my own choice, I would probably have taken no other subject.

We can bring the fluids of the mouth into three classes: Normal fluids, Normal fluids in a state of disease, and fluids brought into the mouth from without.

The most important of the first is saliva. All of you are familiar with this secretion, but perhaps you have not all directed your attention to the point that there is a difference in the secretion of the three salivary glands—the parotid, sublingual and submaxillary.

The secretion of the parotid glands is the most voluminous. According to experiments of Lehman, about seven-tenths of all the saliva secreted is derived from these glands, two-tenths come from the submaxillary, and one-tenth from the sublingual. Compared with the great amount of the secretion of the parotid gland, there goes a greater dilution, while the secretion of the sublingual gland is very much more concentrated.

The specific power of saliva to convert starch into sugar is due to the principle ***ptyaline,*** which is secreted in largest amount by the sublingual gland. Besides ptyaline, saliva contains a large amount of salts, of mucus and of epithelial shreds.

Those who have studied the origin of tartar on the teeth seem to be forced to attribute the formation of the lime-salts to the saliva; but I am not at all prepared either to defend or to attack the theory, because I have not yet studied it, and know nothing about it.

The other liquids of the mouth, like mucus, etc., have not been separated enough by chemists to allow of their being treated with exactness.

The second class of liquids we have to consider are normal ones in a state of disease.

You are familiar with ptyalism or salivation produced by the use of mercurial drugs.

During this affection, the amount of ptyaline in saliva is not increased; but the total quantity of saliva is very much increased.

Saliva has an invariable, neutral or alkaline reaction. I think that only once I could observe an acid secretion from the submaxillary gland; but the case is doubtful.

Saliva, when fermenting or decaying, becomes very offensive.

To what is this offensiveness due? You have read of the famous experiment of Prof. Liebig, of Munich, who produced this offensive odor artificially. He heated meat, bread, and similar substances, with caustic potash to a certain degree of heat; dissolved them in water, added a strong acid, and liberated the organic acids which have that odor of putrid substances. From this experiment, we can say that the putrid odor is due to some product of imperfect oxidization.

If you let saliva stand in glass, exposed to the air, after a short time it will become of a strongly alkaline reaction and a very offensive odor.

The third class of liquids are those introduced into the mouth from without. This leads me to another subject, little touched by essayist, and that is the sense of taste.

What is taste, and what kinds of taste may we distinguish? It seems to me that there are three pairs of tastes opposite to each other—the alkaline and acid, sweet and salt, bitter and metallic. It is strange that our taste universally refuses alkaline food. If we except the few cases of people eating half decayed fish, or mush of Indian meal with saleratus forming a kind of soap, etc., all our food is prepared to suit acid, sweet, salty and bitter tastes. Probably since millions of years our ancestors have become used to prefer acid food to alkaline or any other, and we cannot doubt that our teeth and all our organs have adapted themselves to this want. How can teeth adapt themselves to acids?

You are all familiar with the fact that any acid will dissolve tooth substance. The only way in which the tooth can protect itself is by supplying the loss.

The question of the teeth being endowed with nutrition is very much disputed.

Galen, the old Roman doctor, maintained that teeth have a circulation and a supply, but almost universally dentists now-a-days do not accept the same theory. This seems to me perhaps erroneous. It is true, the fact of a supply has to be proved, but I simply put up a hypothesis either to be proved or disproved.

As long as we know nothing exact about the circulation of a tooth, we cannot say anything definite about supply or non-supply.

I tried a few experiments in that direction. I rinsed my mouth carefully and tested with oxalic acid. The last rinsing-water I used showed no lime-salts present. I then took some chemically pure

acetic acid and water, mixed them to give about strength of common vinegar, assuring myself that no lime-salts were in it, and rinsed my mouth with this liquid. By testing it afterward I found a considerable amount of lime-salts dissolved.

By some experiments which were made some years ago, I found that a tooth was completely dissolved in vinegar in the space of one week. If we calculate this up to the average time which a man is likely to keep sour food in his mouth, we would find that the teeth of a German, who eats the most sour food of any nation I know of, like sauer-kraut, pickles, sour roast beef, sour game, etc.; drinks sour wine and sour wheys and beer, would be completely dissolved in seven or eight years. But nothing of that kind takes place. They are rather stronger than those of the Americans, who eat but little sour.

As to the acid introduced into the mouth, the most common one is acetic acid or vinegar. Very common is also malic acid, the acid in apples, tomatoes, currants and gooseberries, citric acid in lemons and oranges, lactic acid in sour milk, butyric acid in butter, and few rare fruits, like bananas. All these acids form soluble salts with the lime-salts in teeth. Oxalic acid in rhubarb, etc., forms insoluble salts, it is true, but it destroys the teeth nevertheless. As to the influence of acids on the decay of teeth, you know my opinion, and I will leave anything in that line to be brought out by the discussion.

Dr. HITCHCOCK: If I am not mistaken, Prof. Mayr stated that albuminous substances, in decaying, always give alkaline products. I wish to relate an experiment relative to that point. I let some saliva stand in a glass, and tested it continually, and found it acid until I had to throw it away because of its offensiveness.

Prof. MAYR: That is a very important point. If you expose fresh saliva to the action of the germs in the air, you first get a fermentation of the mucus and different non-nitrogeneous substances in the saliva; but after this fermentation has passed away, real putrefaction commences. As I have repeatedly stated, the difference between fermentation and putrefaction is that fermentation is the change of organic non-nitrogeneous substances into other organic non-nitrogeneous substances by the presence of lower organism. Putrefaction is the change of albuminous substances into offensive products by the presence of lower organisms. During fermentation, the reaction is acid; but, during putrefaction, it is alkaline.

I do not blame the Dr. that he threw away the saliva after it had commenced to give offensive odors. Here putrefaction commenced.

The specific power of the parotid gland is very weak. Every one of you can make the experiment without any difficulty. He will find that starch and saliva of the parotid glands will have become putrid before it will show decided signs of the formation of sugar. On the other hand, the secretion of the sublingual gland is most powerful in bringing about this result. In our experiments, we find besides, that raw, unboiled starch is transformed into sugar with considerable difficulty; but if boiled starch be mixed with a very small amount of mixed saliva, chemical tests will show the formation of sugar in a very few minutes.

Dr. MERIAM, Salem, Mass., draws attention to the observations made that tincture of iodine painted on a normal tooth will stick to it; but if the tooth has been scoured, it will not more adhere.

He thinks that there exists some kind of protective layer all over the surface of the tooth.

Prof. MAYR thinks there is something worth noting in the suggestion.

Dr. WHITTEN asks how we have to explain the fact that dead teeth are not dissolved in the mouth by the continuous use of acids, if the teeth, according to Prof. Mayr's description, are only protected against destruction by a continual supply of lime-salts.

Prof. MAYR thinks that the history of the development of the teeth shows that the enamel is independent from the dentine, at least in a great measure, and that it is very well possible that the dentine be dead and the enamel alive. What we call dead teeth are generally teeth with dead dentine; but the enamel, with a circulation of its own, must remain alive some time after the dentine has died. We must never forget that the enamel is a surface organ, and that its minute microscopical structure is certainly arranged with reference to outside influences. We do not yet understand the detail, but we cannot doubt that there is such a connection between ends and means.

Dr. NILES, referring to the experment of Prof. Mayr, which was to the effect that acids at the very moment of application to teeth immediately dissolve the tooth substance, suggests that lime-salts may have been derived from the saliva which would be abundantly secreted under the conditions of the experiment, etc.

The eighteenth annual session of the Maine Dental Society will be held in Portland, Tuesday and Wednesday, July 17 and 18, 1883.

DANA W. FELLOWS, *Secretary*.

NOTICE TO STATE BOARDS OF DENTAL EXAMINERS.

There will be held at the Cataract House, Niagara Falls, on Monday, August 6, 1883, at 2 o'clock P. M., a meeting of the various State Boards of Dental Examiners, for the purpose of perfecting the organization of a National Association of State Boards. It is hoped that every Board will be fully represented.

GEO. H. CUSHING,
Sec'y of Conference held at Lexington, Ky.

NOTE TO MEMBERS OF THE CONN. VALLEY DENTAL SOCIETY.

The meeting of the American Dental Association will be held this year at Niagara Falls, commencing August 7, and it is desirable that we should be well represented.

The meetings are always well worth attending, as they are the means of bringing together leading members of the profession from all parts of the country. The place, also, is one which every American, at least, must desire at some time to visit.

Go and take your wife with you, and if you haven't one, get one.

We are entitled to some twenty-five delegates. Credentials will be furnished on application to Dr. A. M. Ross, Chicopee, Mass.

N. MORGAN, *President.*

THE AMERICAN DENTAL ASSOCIATION will meet at Niagara Falls, the first Tuesday in August, at 10 A. M.

The Committee on Credentials, and the Treasurer, will be at the place of meeting at 8 A. M. Tuesday, at which time it is hoped that members and delegates will present their credentials and pay their dues before the hour for the regular meeting.

The afternoon of Tuesday will be set apart for the meeting of the different sections, to enable them to complete their reports to be presented to the general association.

J. N. CROUSE,
Chairman Executive Committee.

THE AMERICAN DENTAL CONVENTION will hold its meeting for 1883 at Saratoga Springs, N. Y., commencing on the second Tuesday in August, and to continue for three days.

A large attendance is expected, and several interesting papers are already promised by prominent men in the profession.

Programmes, etc., will soon be issued. In the meantime, particulars may be obtained by addressing the President, Dr. F. Y. Clark, or Dr. A. C. Rich, Secretary, Saratoga.

SELECTIONS.

A NEW AID TO DIAGNOSIS.

Some of our readers may perhaps have noticed, in a paragraph published by the *British Medical Journal* upon the death of Dr. Beard of New York—who, it may be remembered, spoke at one of the meetings of our Section at the International Medical Congress in support of the views of his friend, Dr. Norman Kingsley—the surprising statement that at first his fatal illness had been attributed to the presence of an amalgam filling in one of his teeth. The tooth was extracted, but he did not rally, and died after a few days of pneumonia—a disease which it is not usually impossible to diagnose at a tolerably early stage. A full report of the case is not before us, but as it is not the first, and it may be feared will not be the last, instance in which an amalgam monomaniac will air his pet theory, it may be worth while to prick the bubble before it has soared too far.

In the pseudo-scientific writings of some of our transatlantic friends —for happily this particular aberration has its home for the most part across the sea—blindness, headache, insomnia, loss of flesh, vertigo, neurasthenia, diarrhœa, constipation, the milder forms of mental disturbance, and the degeneration of civilized man, have all been attributed to the curse of amalgam fillings. What is most surprising is that those affected—the monomaniacs, not the owners of the amalgam fillings—do not meet with a case now and then, they reckon them by hosts; and what is more, they cure the tissue degenerations, which may often from the symptoms be fairly inferred to have taken place, in the twinkling of an eye by the removal of the base material and the substitution of lengthy gold fillings, at no small profit—to the patient. They are fond of rushing into print, but here they are less successful, for they give so little reason for the faith that is in them that the unbelievers have an unjustifiable habit of refuting their conclusions out of their own mouths, and relentlessly showing from internal evidence how little credence need be given to their statements. This, however, is the common lot of all reformers. Still, so far, the unbelievers have had the best of it, for a single well-observed and well-recorded observation of constitutional damage from this cause has yet to appear.

But with such we must not confound bright exceptions like Dr. Talbot, who, calling to their aid the resources of physics and of chemistry, experiment with all the accuracy that these sciences afford. The

delicacy of the methods employed is beautifully illustrated in an experiment in which he administered to a dog a dose (homœopathic) of mercurius vivus, of known but considerable dilution, and then found by the aid of a powerful microscope globules of real metallic mercury in the blood. Had we only the necessary data, a very interesting calculation might have been made with reference to this experiment, but we are debarred from working out our sum, since we are not told what was the weight of the dog, the probable amount of blood in its body, the amount examined in the field, the proportion of mercurial globules to blood corpuscles, etc., etc.; and this is unfortunate since in the absence of this information the sceptical mind might be apt to fancy that the dose of mercurius vivus must have been rather like the widow's cruse of oil.

If this sort of writing, and of argument, is to be tolerated, it will soon come to pass that the medical adviser, unable to refer a difficult case to the convenient and comprehensive heads of gout or syphilis, will look into the mouth, joyfully hail the sight of an amalgam filling, and look no further for the source of his patient's woes. But there may be a brighter side to this. Mercury is an anti-syphilitic, and in properly selected cases an amalgam filling may be productive of absolute benefit. Our homœopathic friends will find an amalgam filling of given weight, worn for a given number of days, an elegant method of exhibiting the drug. At all events we freely present them with the idea, whatever it may be worth.—*The Journal of the British Dental Association.*

"Thou hast embarked, thou hast made the voyage, thou art come to shore; get out."—*Antoninus.*

"As the child is born or comes into life by leaving the womb, so the soul may, on leaving the body, pass into another existence which is perfect."—*Antoninus.*